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# प्लास्टिक — परीक्षण पद्धतियाँ

## भाग 11 विशेष गुणधर्म

### अनुभाग 14 फिल्म और शीटिंग — गर्म करने पर आयामीय परिवर्तन ज्ञात करना

*Indian Standard*

# PLASTICS — METHODS OF TESTING

## PART 11 SPECIAL PROPERTIES

### Section 14 Film and Sheeting — Determination of Dimensional Change on Heating

ICS 83.080.01

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**BUREAU OF INDIAN STANDARDS**
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NEW DELHI 110002

*August* 2006

**Price Group 2**

Plastics Sectional Committee, PCD 12

## NATIONAL FOREWORD

This Indian Standard (Part 11/Sec 14) which is identical with ISO 11501 : 1995 'Plastics — Film and sheeting — Determination of dimensional change on heating' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Plastics Sectional Committee and approval of the Petroleum, Coal and Related Products Division Council.

The text of ISO Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma ( , ) has been used as a decimal marker while in Indian Standards, the current practice is to use a point ( . ) as the decimal marker.

In this adopted standard, reference appears to the following International Standard for which Indian Standard also exists. The corresponding Indian Standard which is to be substituted in its place is listed below along with its degree of equivalence for the edition indicated:

| *International Standard* | *Corresponding Indian Standard* | *Degree of Equivalence* |
|---|---|---|
| ISO 291 : 1997 Plastics — Standard atmospheres for conditioning and testing | IS 196 : 1966 Atmospheric conditions for testing (*revised*) | Technically Equivalent |

For tropical countries like India, the Standard temperature and the relative humidity shall be taken as 27 ± 2°C and 65 ± 5 percent respectively.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

# *Indian Standard*

# PLASTICS — METHODS OF TESTING

## PART 11 SPECIAL PROPERTIES

## Section 14 Film and Sheeting — Determination of Dimensional Change on Heating

## 1 Scope

This International Standard specifies a method of determining the dimensional change, in the longitudinal and transverse directions, of plastic films and sheeting on heating. This method may be applied to plastic sheets, whether qualified as thermoshrinking or not, up to 1 mm thick.

## 2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 291:1977, *Plastics — Standard atmospheres for conditioning and testing.*

## 3 Principle

The test consists of

a) measuring the initial lengths of two gauge lengths marked on each specimen in the longitudinal and in the transverse direction;

b) heating the specimens for a specified time at a specified temperature on a kaolin bed in an oven;

c) measuring the longitudinal and transverse gauge lengths again after cooling, and subsequently calculating the changes in the gauge lengths.

## 4 Apparatus

**4.1 Circulating-air oven**, of such a size that the total volume of the test assemblies (kaolin beds plus test specimens) does not exceed 10 % of the free space in the oven. Provision shall be made for placing the test assemblies on shelves so that they are not less than 50 mm from each other and from the sides of the oven.

Provision shall be made for circulation of air through the oven at a rate which gives a minimum of six air changes per hour. The temperature of the oven shall be thermostatically controlled to maintain the temperature of the test assemblies within ± 2 °C of the specified temperature (within ± 1 °C if the specified temperature is less than 100 °C).

**4.2 Metal container**, containing a kaolin bed of depth approximately 20 mm. Its other dimensions shall be such that the specimens can be placed flat within it, without deformation, and such that it can be placed in the oven.

**4.3 Temperature-measuring device**, whose tip can be immersed in the kaolin bed.

**4.4 Graduated scale**, capable of measuring to the nearest 0,5 mm.

**4.5 Stopwatch**.

## 5 Test specimens

Samples of film or sheet shall be conditioned for a minimum of 2 h in one of the standard atmospheres specified in ISO 291 prior to cutting out and measuring test specimens.

Three specimens shall be prepared, with approximate dimensions of 120 mm × 120 mm, cut from the centre and two sides of the film or sheet. The side specimens shall be taken at least 50 mm from the edge of the film or sheet.

## 6 Procedure

Place the metal container containing the kaolin bed (4.2) in the oven (4.1) and control the temperature such that the bed is within the specified temperature limits.

Mark the longitudinal (or machine) direction and the transverse direction of the sheet on the specimens as indicated in figure 1.

Mark the longitudinal and transverse gauge lengths ($L_0$ and $T_0$) centrally on the specimens as indicated in figure 1 and measure each to the nearest 0,5 mm using the graduated scale (4.4).

Dust the specimens with kaolin and place them flat on the kaolin bed. Maintain the bed at the specified temperature for the period of time applicable to the material under test.

Examples of temperatures and heating times are given in annex A for a variety of film and sheeting materials.

At the end of the heating period, remove the specimens from the kaolin bed and condition them for at least 30 min in the same atmosphere as was used to condition the sample. Remeasure the longitudinal and transverse gauge lengths ($L$ and $T$).

## 7 Expression of results

For each specimen, calculate the change in the longitudinal and transverse gauge lengths, expressing the change as a percentage of the initial gauge length, using the equations:

$$\Delta L = \frac{L - L_0}{L_0} \times 100$$

and

$$\Delta T = \frac{T - T_0}{T_0} \times 100$$

where

$L_0$ and $T_0$ are the original gauge lengths, in millimetres;

$L$ and $T$ are the gauge lengths after heating, in millimetres.

NOTE 1 $\Delta L$ and $\Delta T$ can be positive or negative. A negative value corresponds to shrinkage and a positive value to elongation of the film or sheet.

Calculate the mean value for the three specimens, in each direction (longitudinal and transverse), rounding the result to one place of decimals.

## 8 Precision

The precision of this test method is not known because inter-laboratory data are not available. When inter-laboratory data are obtained, a precision statement will be added at the following revision.

## 9 Test report

The test report shall include the following information:

a) a reference to this International Standard;

b) all details necessary for the complete identification of the material tested;

c) the test temperature;

d) the heating time;

e) the mean percentage change in gauge length;

f) the direction of the change (longitudinal or transverse);

g) the date of the test.

Dimensions in millimetres

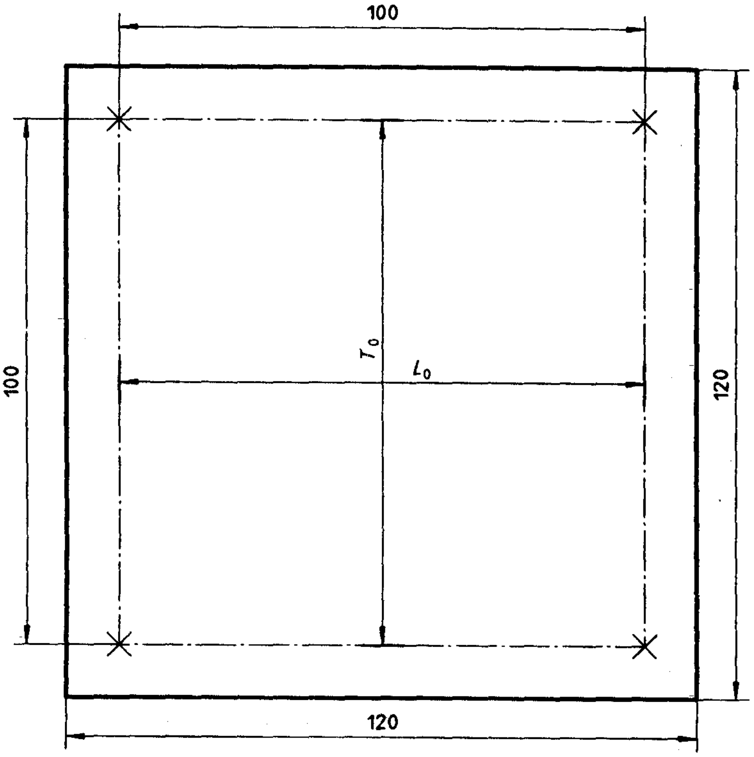

Figure 1 — Specimen dimensions and gauge lengths

# Annex A
(informative)

# Examples of temperature and heating time

## A.1 Heating time

It is suggested that the following heating times be used for the test:

5 min for non-shrink film and sheeting which is not intended for processing at high temperatures.

30 min for film and sheeting which is intended to be thermoshrunk or thermoformed.

## A.2 Temperature

Table A.1 may be used as a guide for the test.

**Table A.1 — Recommended temperatures**

Values in degrees Celsius

| Material | Non-shrink | Thermoshrinking/ thermoforming |
|---|---|---|
| Unplasticized PVC | 85 | 125 |
| Plasticized PVC | 70 | 125 |
| Chlorinated PVC | 100 | 150 |
| ABS | – | 125 |
| High-density polyethylene | 125 | 150 |
| Polypropylene | 125 | 175 |
| Cellulose acetate | 125 | 150 |
| PMMA | 160 | 160 |
| Low-density polyethylene | 100 | 150 |

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This Indian Standard has been developed from Doc : **PCD 12 (1805)**.

**Amendments Issued Since Publication**

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